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Natural, social, economical and political influences on fisheries: A review of the transitional area of the Polish waters of the Vistula Lagoon

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ABSTRACT

A 60 year (1948–2007) dataset gathered by Polish researchers working on the Vistula Lagoon fish assemblages and fisheries has shown this stressed transitional environment to be always been dominated by a few highly abundant fish species. During this period, the surrounding countries Poland and Russia (Kaliningrad) were transformed from centrally-planned economies with fixed prices to free market systems. The organization of the fishery evolved from one in which the majority of the fishing effort was expended by cooperatives, to one which was characterized by individual economic activity. The fishing gear deployed also evolved from cotton to monofilament, as well as from large sailing vessels with small-sized pair trawls to fyke nets targeting eel (*Anguilla anguilla*) and pound nets targeting herring (*Clupea harengus*). Small-sized gillnets targeting perch (*Perca fluviatilis*) grew in popularity as eel and pikeperch (*Sander lucioperca*) catches decreased. Cooperation between Polish and Russian fishery managers began in 1952 with the aim of implementing joint agreements to establish protection guidelines. The substantial nutrient loads into the lagoon in 1970 and 1980 put very large pressure on the environment, and contributed to the loss of macrophytes as well as the development of non-commercial fish populations. One of the consequences of these changes was the rapid growth of a black cormorant (*Phalacrocorax carbo*) breeding colony. These multi-faceted changes are considered to be the factors that have influenced the exploitation of fish assemblages in the Polish part of the Vistula Lagoon.

The most evident change in the fish assemblage structure during the study period was the permanent decrease in the basin's top predators – pike (*Esox lucius*) and pikeperch. Eel stocking was initiated in 1970 following a crucial decline in yield from natural recruitment, and stocking was successful in increasing eel abundance.

1. Introduction

The impact from the mixing of fresh lagoon and saline Baltic waters is the main source of ecological pressure on the Vistula Lagoon environment. The Vistula River flowed into the Baltic Sea through the Vistula Lagoon until 1895, when the area was heavily impacted by high human intervention. A channel was built to redirect most of the Vistula River outflow from the Gdansk precincts through the shortest route to the Baltic. In 1914, as part of the Vistula River engineering project, another arm of the Vistula, the Nogat River, which flowed directly into the Vistula Lagoon, was cut-off by sluices (Fig. 1). This immediately affected migratory fish species, such as salmon (*Salmo salar*), trout (*Salmo trutta*), and vimba bream (*Vimba vimba*), and then impacted the salinity of the Vistula Lagoon. The lagoon was now more susceptible to currents flowing through the Pilava Strait, which is the lagoon's only connection with the Baltic Sea. This new situation influenced a change in fish assemblages from freshwater species to brackish species.

Until 1945, the Vistula Lagoon was in German territory, but following World War II it was divided between Poland and the then USSR. The German fishers who had been active in the area prior to the war were displaced, and new settlers were brought in and organized into fishery cooperatives. All official marketing and trade was organized by the government, and this led to a disconnect between costs and benefits. As a consequence, an unofficial, and more profitable, market for some fish species (mainly eel) became popular. Rapid urbanization and the development of industry and tourism without the accompanying wastewater management facilities created new problems for the Vistula Lagoon; namely, environmental degradation including eutrophication, excessive algal blooms, and a decline in macrophytes. These were accompanied nearly simultaneously by declines in catches of the most valuable fish species. The transition to a market economy after 1989 only served to worsen this trend, but it was now not only fishery exploitation that impacted fish assemblages. Another potentially important factor for the fish assemblages involved a large-scale increase

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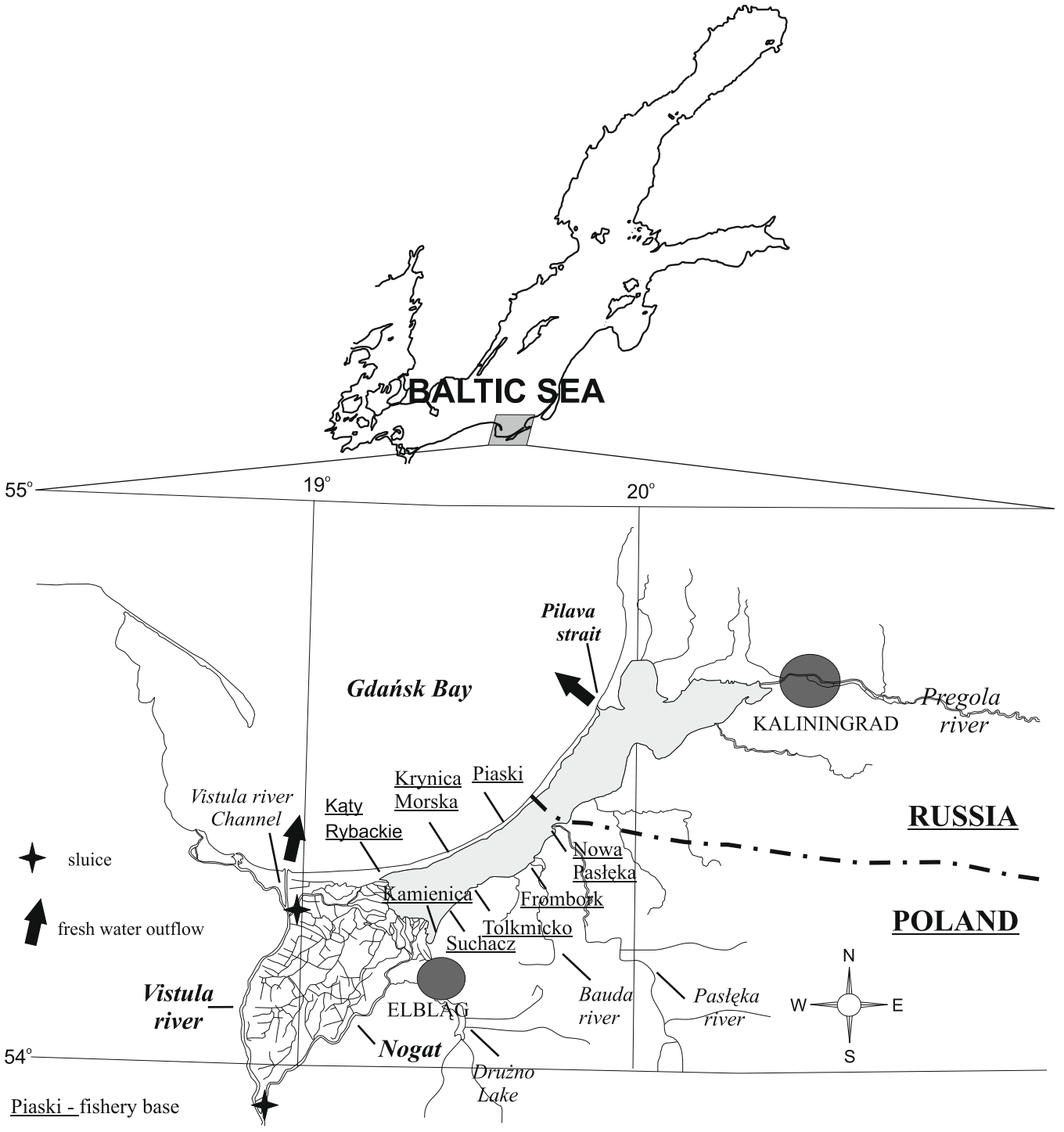

Fig. 1. Map of the Vistula Lagoon.

in the black cormorant breeding colony, and an increase in herring reproductive success on the Vistula Lagoon spawning grounds. This paper reviews and analyses how the overall changes in the political and economic status quo, as well as those in the environment, over the past 60 years have affected catches in the Polish waters of the Vistula Lagoon.

2. Changes in the ecosystem of the Vistula Lagoon

Hydrographic research in the Polish waters of the Vistula Lagoon began in 1951 (Żmudziński and Szarejko, 1955). Due to notable increases in phytoplankton blooms and the worsening of water quality, these studies were repeated 20 years later (Różańska and Więcławski, 1978; Pliński et al., 1978). A review of all the hydrobiological issues was subsequently published by Pliński (2005). From the viewpoint of fish assemblages and fishery issues, the eutrophication process recorded during the 1970s was the most significant issue facing the lagoon. The phosphorus content increased in the early 1970s, while the nitrogen content increased sharply in the late 1970s. Water transparency has always been poor in the Vistula Lagoon due to the basin's shallow depths and soft muddy bottom that render it prone to wind-induced mixing in the water column.